

### REMARKS

Claims 12 to 15 and 21 to 29 were rejected under 35 U.S.C. §103(a) as being unpatentable over either one or of EP 0 196 655 to Ohashi et al. (hereinafter "Ohashi") or U.S. Patent No. 5,094,805 to Suchy et al. (hereinafter "Suchy") in view of U.S. Patent No. 3,366,546 to Anthony et al. (hereinafter "Anthony") alone or further in view of U.S. Patent No. 5,416,813 to Hiraiwa (hereinafter "Hiraiwa"). Claims 16 to 20 were rejected under 35 U.S.C. §103(a) as being unpatentable over either one of Ohashi or Suchy in view of Anthony, and where necessary, further in view of U.S. Patent No. 4,224,106 to Delafosse (hereinafter "Delafosse").

Claims 12, 18, 19, 20 and 22 to 25 have been amended. Claims 15 to 17 have been canceled. Claims 30 to 36 have been added.

Reconsideration of the application based on the foregoing amendments and the following remarks is respectfully requested.

#### 35 U.S.C. §103 Rejections

Claim 12 now includes the limitations of claim 17, which was rejected under 35 U.S.C. §103(a) as being unpatentable over either one or of Ohashi or Suchy in view of Anthony, and, where necessary, further in view of Delafosse.

Ohashi discloses a fuel assembly adapted to be loaded in the core of a nuclear fuel reactor. *Ohashi specifically states that two types of fuel rods with different reactivity at the outer peripheral zone makes it "difficult to equalize the distribution of local power output."* See page 4, lines 20 to 26 of Ohashi.

Suchy discloses interior fuel rods 8A and smaller fuel rods 10 "located farther away" including the four peripheral edges. See col. 8, lines 27 to 65 of Suchy.

Anthony discloses an arrangement of guide rods 46. See Fig. 5 to 9 and 14. It is preferable in most instances that the guide rods not contain fuel, but Anthony states that if it is desired to use such tubes as guide rods 46, they could "either be poison containing tubes or fuel containing tubes in which case they might contain a fuel of lower enrichment. In the case

of the lower fuel enrichment there would not be such a pronounced tendency for temperature differential and thus their use might be permissible. *Since there normally is a neutron flux peak adjacent the corners of the fuel assembly, it might, in certain instances, be advantageous to employ guide rods containing a burnable poison in that area to reduce neutron flux.*" See col. 6, lines 60 to 75.

Delafosse discloses that reactivity is a function of enrichment and teaches making fuel elements in the shape of plates. See col. 3, lines 6 to 35.

Claim 12 has been amended to include the limitations of claim 17 to recite a fuel assembly for a pressurized water nuclear reactor, comprising:

fuel rods which are arranged at nodes of a substantially regular network having a polygonal outer contour, the fuel rods containing uranium which is enriched in isotope 235 and not containing any plutonium before the assembly is used in a reactor, wherein the rods are distributed in at least:

a first central group which is constituted by fuel rods which have a first level of enrichment e1 in uranium 235; and

an outer peripheral layer of fuel rods distributed in:

a second group of fuel rods that extend along faces of the outer contour of the network and that have a second level of enrichment e2 in uranium 235 strictly less than the first level of enrichment e1; and

a third group of fuel rods that are arranged at corners of the outer contour of the network and that have a third level of enrichment e3 in uranium 235 that is strictly less than the second level of enrichment e2

wherein the outer peripheral layer of fuel rods defines an outer periphery of the fuel assembly."

Neither Ohashi nor Suchy, admittedly, show that the outer peripheral layer can having varying enrichments as claimed.

More important, both Ohashi and Suchy, it is respectfully submitted, do not want varying enrichments on the outer periphery. Ohashi specifically teaches that varying

reactivity on the periphery makes it *"difficult to equalize the distribution of local power output."* See page 4, lines 20 to 26 of Ohashi. Ohashi therefore specifically has equally reactive outer peripheral fuel rods. See page 9, line 21 to 22 of Ohashi for example: "the fuel rods having a substantially fixed factor of enrichment." Suchy teaches different sized fuel rods at the interior, but specifically has all the outer periphery rods at the same diameter. See col. 8, lines 46 to 48 of Suchy.

As such, it is respectfully submitted that one of skill in the art, under any teaching, would not have modified either the Ohashi or Suchy fuel assemblies to provide a different enrichment at the corners as now claimed in amended claim 12.

It is further noted that Ohashi does not, it is respectfully submitted, disclose "the fuel rods containing uranium which is enriched in isotope 235 and not containing any plutonium before the assembly is used in a reactor" and that the depleted uranium noted in the Office Action is still in the mixture of uranium oxide and plutonium oxide fuel (MOX). The note in Table 1 of Ohashi only states that depleted uranium can be used instead of natural uranium in the MOX. In no way can this be construed to mean the depleted uranium could be used instead of MOX. Natural uranium has a content of 0.72% 235U which is not sufficient to produce a self-sustaining critical chain reaction in a light water reactor. Depleted uranium has a content which is less than 0.711% 235U and usually in the range of 0.2 to 0.4% 235U, i.e. far too low to be used as a nuclear fuel in a light water reactor.

Applicant's reincorporate their previous arguments with respect to Ohashi, including that Ohashi teaches away from using different enrichments but rather uses different fuel diameters.

With respect to Anthony, Anthony recognizes a neutron flux peak at the corners of the fuel assembly, and Anthony notes lower enrichment or burnable poisons for its *guide rods* in general.

However, Anthony's solution to the specific problem of corner neutron flux peaks is *not* to provide a different enrichment in a corner fuel rod, but rather explicitly that guide rods "in that area" should contain a burnable poison. See col. 6, lines 68 to 75 of Anthony. Thus Anthony does not teach the limitation of "a third group of fuel rods that are arranged at

corners of the outer contour of the network and that have a third level of enrichment e3 in uranium 235 that is strictly less than the second level of enrichment e2" for at least two reasons:

- (1) *Anthony teaches that the guide rods in the area near the corners specifically should contain a poison rather than be of a lower enrichment; and*
- (2) *the guide rods 46 that Anthony is talking are not located at the corners of the fuel assembly but rather merely in the area near the corners, with the fuel rods 24 being at the actual corners. See Figs. 5, 7 and 8 which clearly show guide rods 46 not being at the corners. Fuel rod 24 is.*

Delaforosse does not teach anything on corner enrichments, and it is noted that Hiraiwa, while not applied against claim 17, is directed to the specific issue of placing a burnable poison rod in the middle of a fuel assembly, and it is respectfully submitted, not applicable to Ohashi or Suchy.

Since all of the limitations of amended claim 12 are not met by Ohashi and Suchy in view of Anthony with or without Delaforosse, withdrawal of the rejection to claim 12 under 35 U.S.C. §103(a) is respectfully requested.

Claim 22 recites a nuclear reactor core with fuel assemblies where the rods are distributed in only:

a first central group which is constituted by fuel rods which have a first level of enrichment e1 in uranium 235; and

an outer peripheral layer of fuel rods distributed in:

a second group of fuel rods that extend along faces of the outer contour of the network and that have a second level of enrichment e2 in uranium 235 strictly less than the first level of enrichment e1; and

a third group of fuel rods that are arranged at corners of the outer contour of

the network and that have a third level of enrichment e3 in uranium 235 that is strictly less than the second level of enrichment e2

wherein the outer peripheral layer of fuel rods defines an outer periphery of the fuel assembly.

Support for the amendment is found for example at page 7, lines 9 to page 8, line 15 describing the three groups.

In addition to the arguments with respect to amended claim 12, neither Ohashi nor Suchy disclose rods distributed only with the three groups as now claimed, and it is respectfully submitted that claim 22 is allowable for this reason as well.

#### New claims

New claim 30 finds support for the amendment for example at page 7, lines 9 to page 8, line 15 describing the three groups, and is respectfully submitted as patentable in view of the above comments with respect to claims 12 and 22.

**CONCLUSION**

It is respectfully submitted that the application is in condition for allowance and applicants respectfully request such action.

If any additional fees are deemed to be due at this time, the Assistant Commissioner is authorized to charge payment of the same to Deposit Account No. 50-0552.

Respectfully submitted,

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